SOLUTIONS

PROGRESS TEST-4

CD-1802

JEE ADVANCED PATTERN

Test Date: 09-09-2017

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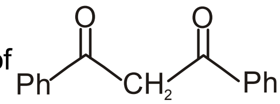
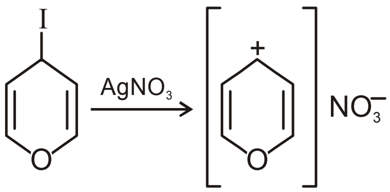
CHEMISTRY

1. **(C)**

% of enolic content is high incase of  due to presence of two phenyl group extent of conjugation becomes very high.

(ii) due to intramolecular H–bording.

2. **(A)**



Aromatic ion

3. **(C)**

Site (c) is more basic due to localisation of lone pair of nitrogen atom. But in case of site (a) and (b) lone pair electron is delocalised.

4. **(C)**

$$\frac{r_2}{r_1} = \frac{P_{A_2} \cdot P_{B_2}^2}{P_{A_1} \cdot P_{B_1}^2} = \frac{0.1 \times (0.4)^2}{0.4 \times 1^2} = \frac{1}{25}$$

5. **(C)**

For an ideal solution $\Delta H_{mix} = 0$ and ΔS_{mix} is always positive so ΔG_{mix} is negative.

6. **(D)**

Only solvent molecule can pass through SPM.

Osmotic pressure $\pi \alpha iC$ (at constant T)

7. **(D)**

$Li_2CO_3 \xrightarrow{\Delta} Li_2O + CO_2$

$LiBF_4 \xrightarrow{\Delta} Li_2F + BF_3$

$BeSO_4 \xrightarrow{\Delta} BeO + SO_2 + \frac{1}{2}O_2$

$Na_2O_2 \xrightarrow{\Delta} Na_2O + \frac{1}{2}O_2$

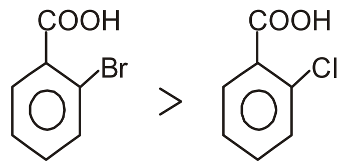
$BeCO_3 \xrightarrow{\Delta} BeO + CO_2$

8. **(A)**

N^{3-} and O^{+} respectively.

9. (A), (B)

$CHCl_3$ is more acidic than CHF_3 because its conugate base $\overset{\ominus}{C}Cl_3$ is more stablised due to d orbital resonance. Which is albsent in $\overset{\ominus}{C}F_3$ ion.



magnitude of ortho effect is very high incase of large Br atom.

10. (A), (B), (C)

For an elementary reaction $aA + bB \longrightarrow cC + dD$ rate law is always r = k[A]^a[B]^b but not vice versa.

For a complex reaction $aA + bB \longrightarrow cC + dD$ rate law may or may not be r = k[A]^a[B]^b

11. (A), (B), (D)

In case of phenyl carbocation positive charge appears on carbon atom is localised because of presence of vacant sp^2 orbital.

12. (A, B, C, D)

Factual

13. (A), (B), (C), (D)

$$\begin{array}{llll} & A(g) \longrightarrow & 2B(g) + & C(g) \\ t=0 & 400 & & \\ t=20 & 400-x & 2x & x \end{array}$$

So 400 – x + 2x + x = 1000

x = 300 mm Hg

$$K = \frac{1}{20}\ln\frac{400}{100} = \frac{2\ln 2}{20} = 0.0693\ \text{min}^{-1}$$

$$t_{1/2} = \frac{\ln 2}{K} = \frac{0.693}{0.0693} = 10\ \text{min}$$

$$\frac{30}{10} \times \ln 2 = \ln\frac{400}{400-x}$$

$$8 = \frac{400}{400-x} \Rightarrow 400 - x = 50$$

$\Rightarrow$ x = 350 mm Hg

Partial pressure of C after 30 min = 350 mm Hg

Total pressure after 30 min = 400 + 2x = 400 + 700 = 1100 mm of Hg.

14. (B)

For max. con. of B ;

$$\frac{d[B]}{dt} = 0; \text{ so } t_{max} = \frac{1}{k_1 - k_2} \ln \frac{k_1}{k_2}$$

15. (B)

$k_1 << k_2$

so, rate of appearance of B is much lesser than rate of dissappearance of B.

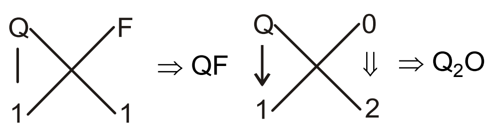
16. (B)

IA alkali metal have low IP and after loss of one electron becomes stable.

17. (C)

18. (B)

Q = Alkali metal F = Fluorine



19. (8)

$$P = \frac{2}{5} \times 5 + \frac{3}{5} \times 10 = 8 \text{ torr}$$

20. (2)

$$48 = \left(\frac{8}{8+x}\right)50 + \left(\frac{x}{x+8}\right)40$$

$$\therefore x = 2$$

21. (4)

$$P = P_A^o + x_B\left(P_B^o - P_A^o\right)$$

$$99 = 100 + x_B(-20) \Rightarrow x_B = \frac{1}{20}$$

$$\therefore y_B = \frac{80 \times \frac{1}{20}}{99} = \frac{4}{99}$$

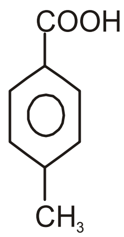
$$\% \text{mole}_B \text{ in vapour phase} = \frac{4}{99} \times 100 = 4$$

22. (2)

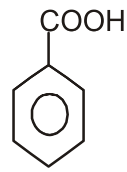
In option (I) H.C effect of C–D bond is less than +H.C effect of C–H bond

In option (III) and (IV) carbocation is stablised by + Reffect of OH and OCH_3.

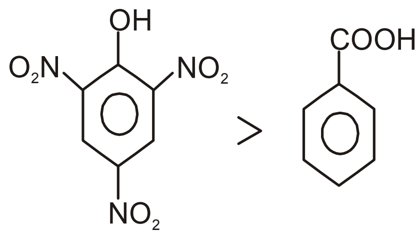
23. (4)



is less Acidic than



deu to + H.C effect of CH_3.



Due to qreater extent of delocalisation of –ve charge present on oxygen atom due to three NO_2 group.

24. (4)

option (A) donot show GI because terminal groups lie in mutual $\perp$ plane.

In option (E) ring is stereogenic unit because two sp^3C is attached with two different atoms H and Br. So E shows GI

25. (2)

Option A and (B) is less stable due to + H.C effect of CH_3 group and + Reffect of OCH_3 group.

option E is also less stable than benzyl carbanion due to localisation of –ve charge.

26. (6)

27. (1)

28. (2)

$$\Delta T_b = \frac{2.6 \times 30 \times 1000}{156 \times 250} = 2$$

MATHEMATICS

29. (B)

$$f(x) = \begin{cases} x - 2k\pi; & 2k\pi - \frac{\pi}{2} \le x \le 2k\pi + \frac{\pi}{2} \\ (2k+1)\pi - x; & 2k\pi + \frac{\pi}{2} < x \le 2k\pi + \frac{3\pi}{2} \end{cases}$$

30. **(B)**

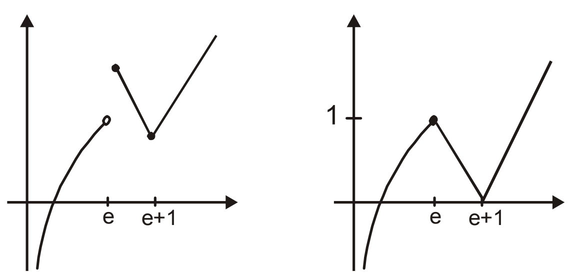
For, $x \in (-2-h, -2+h)$:

$$y = \frac{1}{\ell n(-x)} \quad \Rightarrow \quad y' = -\frac{1}{(\ell n(-x))^2} \cdot \frac{1}{(-x)} \cdot (-1) \quad \Rightarrow \quad y'\big|_{x=-2} = \frac{1}{2(\ell n 2)^2}$$

31. **(C)**

$a^2 \geq 1 \Rightarrow a \in (-\infty, -1] \cup [1, \infty)$

32. **(C)**



$\log_{10}(a^2 - a + 1) \geq 0$

$\Rightarrow \quad a^2 - a + 1 \geq 1$

$\Rightarrow \quad a \in (-\infty, 0] \cup [1, \infty)$

33. **(B)**

$f'(x) = 8x^3 - 9(a-3)x^2 + 12ax + a$

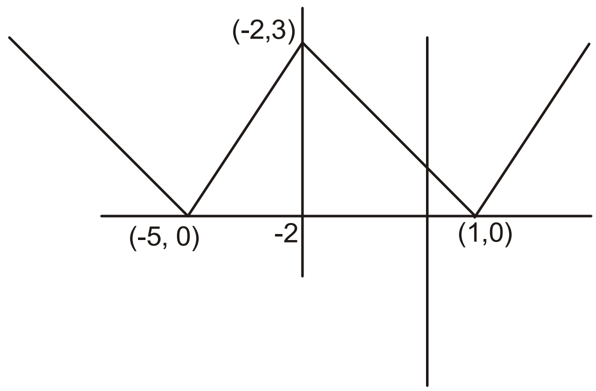
$f''(x) = 24x^2 - 18(a-3)x + 12a$

$= 6 \cdot \{4x^2 - 3(a-3)x + 2a\}$

$f''(x) = 0$ has roots of opposite signs

$\Rightarrow \quad a \in (-\infty, 0)$

34. (A)



$\alpha = 2;\ \beta = 1;\ \gamma = -5$

35. (D)

$$\tan^{-1}\left(\frac{1}{2r^2}\right) = \tan^{-1}\left(\frac{2}{4r^2}\right) = \tan^{-1}\left(\frac{(2r+1)-(2r-1)}{1+(2r+1)(2r-1)}\right) = \tan^{-1}(2r+1) - \tan^{-1}(2r-1)$$

Thus,

$$\sum_{r=1}^{n}\tan^{-1}\left(\frac{1}{2r^2}\right) = \sum_{r=1}^{n}\left[\tan^{-1}(2r+1) - \tan^{-1}(2r-1)\right] = \tan^{-1}(2n+1) - \tan^{-1}(1)$$

$$= \tan^{-1}(2n+1) - \frac{\pi}{4}$$

$$\therefore \lim_{n\to\infty}\sum_{r=1}^{n}\tan^{-1}\left(\frac{1}{2r^2}\right) = \lim_{n\to\infty}\left[\tan^{-1}(2n+1) - \frac{\pi}{4}\right]$$

$$= \tan^{-1}(\infty) - \frac{\pi}{4} = \frac{\pi}{2} - \frac{\pi}{4} = \frac{\pi}{4}.$$

36. (D)

For domain $\ell n\left(\cot^{-1}x\right) > 0$

$\Rightarrow \cot^{-1}x > 1$

$\Rightarrow x < \cot 1$

37. (A, D)

$$f(x) = \begin{cases} ax^2 + bx & \text{for } -1 < x < 1 \\ \dfrac{a-b-1}{2} & x = -1 \\ \dfrac{a+b+1}{2} & x = 1 \\ \dfrac{1}{x} & \text{for } x > 1 \text{ or } x < -1 \end{cases}$$

for continuity at x = 1

$a + b = 1$ ....(1)

for continuity at x = – 1

$a - b = -1 \Rightarrow a - b = -1$ ....(2)

hence a = 0 and b = 1

38. (C)

$$f(x) = \left(\frac{x}{2+x}\right)^{2x}$$

$$\lim_{x\to\infty} f(x) = \lim_{x\to\infty} \left(\frac{x}{2+x}\right)^{2x} = \lim_{x\to\infty} \left(1 + \frac{x}{2+x} - 1\right)^{2x}$$

$$= e^{\lim_{x\to\infty} -4\left(\frac{x}{2+x}\right)} = e^{-4}$$

Also $\lim_{x\to 1} f(x) = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$

39. (A, B)

f(g(x)) is even, periodic, unbounded & positive $\forall x$ in domain.

40. (B, C)

$$\sin^{-1}\left(a^2x^2 + b^2y^2\right) + \cos^{-1}|ax + by| = \pi$$

$$\Rightarrow a^2x^2 + b^2y^2 = 1 \text{ and } ax + by = 0$$

$$\Rightarrow 2axby = -1$$

41. (A, B)

if m < 0, then for values of x sufficiently close to 0

$$1 + \frac{1}{m} < \frac{\sin x}{x} < 1$$

$$\therefore\ m + 1 > m\frac{\sin x}{x} > m$$

$$\therefore\ \left[m\frac{\sin x}{x}\right] = m$$

$$\therefore\ \lim_{x\to 0}\left[m\frac{\sin x}{x}\right] = m$$

If m > 0, then for values of x sufficiently close to 0, we can have

$$1 - \frac{1}{m} < \frac{\sin x}{x} < 1$$

$$\therefore\ m - 1 < m\frac{\sin x}{x} < m$$

$$\therefore\ \lim_{X\to 0}\left[m\frac{\sin x}{x}\right] = m - 1$$

For (42 to 44)

(B, C, D)

$$f(x) = \lim_{n\to\infty}\left(\cos\sqrt{\frac{x}{n}}\right)^n = \lim_{n\to\infty}\left(1+\left(\cos\sqrt{\frac{x}{n}}-1\right)\right)^n$$

$$= e^{-\lim\limits_{n\to\infty} 2\sin^2\left(\frac{1}{2}\sqrt{\frac{x}{n}}\right)n}$$

$$= e^{-2\lim\limits_{n\to\infty}\frac{\left(\frac{1}{2}\sqrt{\frac{x}{n}}\right)^2}{\frac{1}{n}}} = e^{-\frac{1}{2}\lim\limits_{n\to\infty}\frac{\frac{x}{n}}{\frac{1}{n}}} = e^{-\frac{x}{2}}$$

$f(x) = e^{-x/2},\ x \ge 0$ range = (0, 1]

$$g(x) = \lim_{n\to\infty}(1 - x + x\sqrt[n]{e})^n$$

$$= e^{\lim\limits_{n\to\infty} x\frac{(e^{\frac{1}{n}}-1)}{1/n}} = e^x \quad \forall\ x \in R$$

$f(x) = e^{-x/2} \Rightarrow f^{-1}(x) = 2\ell n\frac{1}{x} \quad 0 < x \le 1$

$g(x) = e^{x} \Rightarrow g^{-1}(x) = \ell nx$

$h(x) = \tan^{-1}\left(g^{-1}\left(f^{-1}(x)\right)\right)$

$\therefore \quad h(x) = \tan^{-1}\left(\ell n\left(\ell n\frac{1}{x^2}\right)\right)$ for $0 < x < 1$

42. (B)

$$\lim_{x\to 0+} \frac{\ell nf(x)}{\ell ng(x)} = \lim_{x\to 0} \frac{-x/2}{x} = -\frac{1}{2}$$

43. (C)

domain of h(x) is (0,1)

44. (D)

$h(x) = \tan^{-1}(\ell n(\ell n\, 1/x^2) \quad 0 < x < 1$

$1 < \frac{1}{x^2} < \infty \Rightarrow \quad 0 < \ell n\ \frac{1}{x^2} < ^1$

$\therefore \quad -\infty < \ell n\ (\ell n(1/x^2)) < \infty$

$\therefore$ range of h(x) is $(-\pi/2, \pi/2)$

45. (A)

$f(x) = (x-1)^2 - 2,\ a = 1,\ b = -2$

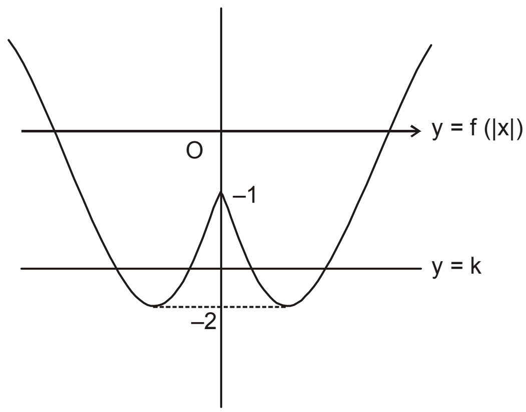
$f : [1, \infty) \to [-2, \infty)$

then $f^{-1} : [-2, \infty) \to [1, \infty)$, $f(x) = y \Rightarrow x^2 - 2x - (1+y) = 0$

$\therefore x = \frac{2 \pm \sqrt{4+4(1+y)}}{2}, \quad x = 1 \pm \sqrt{2+y}$

$\because f^{-1}(y) = 1 + \sqrt{2+y} \Rightarrow f^{-1}(x) = 1 + \sqrt{2+x}$

46. (A)



For f (|x|) = k to be four distinct solutions, $k \in (-2, -1)$

47. (1)

The equation of the curve is $y - e^{xy} + x = 0$

$$\Rightarrow \frac{dy}{dx} - e^{xy}\left(y + x\frac{dy}{dx}\right) + 1 = 0$$

$$\Rightarrow \frac{dy}{dx}(1 - xe^{xy}) = ye^{xy} - 1$$

$$\Rightarrow \frac{dx}{dy} = \frac{1 - xe^{xy}}{ye^{xy} - 1}$$

Clearly, $\frac{dx}{dy} = 0$ at (1, 0). So, required point is (1, 0).

48. (1)

f(0) = 0

49. (1)

f(x) = sinx + 2 – 2x

f(0) = 2 > 0

$f(\pi/2) = 3 - \pi < 0$

$f'(x) = \cos x - 2 < 0 \ \forall x \in R$

$\Rightarrow$ f(x) = 0 will have exactly one real root in $x \in \left(0, \frac{\pi}{2}\right)$

50. (1)

It is possibe only when f(x) is differentiable at x = 1 and $f'(1) \neq 0$.

$\Rightarrow \quad 1+\dfrac{b^3-b^2+b-1}{b^2+3b+2}=-1 \Rightarrow b^3 + b^2 + 7b + 3 = 0$

$f(b) = b^3 + b^2 + 7b + 3$

$\therefore \quad f'(b)=3b^2+2b+7>0 \ \forall b \in R$

$\Rightarrow$ f(b) = 0 will have exactly one real root.

51. (2)

$$\lim_{x\to 0}\frac{\sin x^4 - x^4\cos x^4 + x^{20}}{x^4(e^{2x^4}-1-2x^4)} = \lim_{t\to 0}\frac{\sin t - t\cos t + t^5}{t\left(e^{2t}-1-2t\right)}$$

$$\lim_{t\to 0}\frac{t-\frac{t^3}{3!}+\frac{t^5}{5!}.....-t\left(1-\frac{t^2}{2!}+\frac{t^4}{4!}...\right)+t^5}{t\left(1+2t+\frac{4t^2}{2!}+\frac{8t^3}{3!}+\frac{16t^4}{4!}+....-1-2t\right)} \quad \lim_{t\to 0}\frac{-\frac{t^3}{6}+\frac{t^3}{2}+\frac{t^5}{5!}-\frac{t^5}{4!}+....+t^5}{2t^3+\frac{8t^4}{3!}+...} = \frac{-\frac{1}{6}+\frac{1}{2}}{2}=\frac{-1+3}{12}=\frac{1}{6}$$

52. (5)

$3x-7 \le x^2-3x+2 < 3x-7+1 \qquad \& \ 3x \in Z$

$\Rightarrow 0 \le x^2-6x+9<1 \qquad \& \ 3x \in Z$

$\Rightarrow 2<x<4 \qquad \& \ 3x = n \text{ for some } n \in Z$

$\Rightarrow 2<\dfrac{n}{3}<4 \qquad \& \ x=\dfrac{n}{3}, n\in Z \Rightarrow 6<n<12 \qquad \& \ x=\dfrac{n}{3}, n \in Z$

$\Rightarrow n \in \{7,8,9,10,11\} \ \& \ x=\dfrac{n}{3}, n\in Z \Rightarrow x \in \left\{\dfrac{7}{3},\dfrac{8}{3},3,\dfrac{10}{3},\dfrac{11}{3}\right\}$

53. (7)

Let x = I + f $\quad 0 \le f < 1$

$73\,I + \left[f+\frac{1}{19}\right]+\left[f+\frac{1}{20}\right]+...+\left[f+\frac{1}{91}\right]=546$

Now 546 = 7 × 73 + 35

$\Rightarrow I = 7$

54. (3)

For x > 0, xy > 1

$$\tan^{-1}x+\tan^{-1}y=\pi+\tan^{-1}\left(\frac{x+y}{1-xy}\right) \Rightarrow \tan^{-1}x+\tan^{-1}y+\tan^{-1}\left(\frac{x+y}{xy-1}\right)=\pi$$

55. (6)

$\lim\limits_{x\to1}(1+ax+bx^2)^{\frac{c}{x-1}}=e^3$, For 1^∞ form a + b = 0

or $e^{\lim\limits_{x\to1}\frac{c(ax+bx^2)}{x-1}}=e^3$

or $\lim\limits_{x\to1}\dfrac{c(ax+bx^2)}{x-1}=3$

or $\lim\limits_{h\to0}\dfrac{c(a(1+h)+b(1+h)^2)}{1+h-1}=3$

or $\lim\limits_{h\to0}\dfrac{(ca+b)+(ac+2b)\cdot h+bh^2}{h}=3$

or ca + b = 0 and ac + 2b = 3

or b = 3 and ac = –3

also, a + b = 0, i.e; a = – 3 and c = 1

56. (1)

$\log_b a\log_c a+\log_a b\log_c b+\log_a c\log_b c=3$

Let $\log_e a=x,\quad \log_e b=y,\quad \log_e c=z$

$\Rightarrow\dfrac{x^3+y^3+z^3}{xyz}=3 \Rightarrow x^3+y^3+z^3=3xyz \Rightarrow x+y+z=0$

$\Rightarrow\log_e a+\log_e b+\log_e c=0 \Rightarrow \log_e abc=0 \Rightarrow abc=e^0$

$\therefore abc=1$

PHYSICS

57. (C)

Flux cannot change in a superconduction loop.

$\Delta\phi = 2\pi R^2 .B$

Initially current was zero, so self flux was zero.

$\therefore$ Finally $Li = 2\pi R^2 \times B$.

$i = \frac{2\pi R^2 \times B}{L}$

58. (A)

$U = \frac{1}{2} LI_2$

Rate = $\frac{dU}{dt} = LI\left(\frac{dI}{dt}\right)$

At t = 0 , I = 0

$\therefore$ Rate = 0

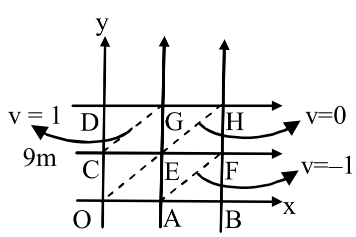
At $t = \infty$, $I = I_0$ but $\frac{dI}{dt} = 0$, therefore, rate = 0

59. (B)

Rate of change of flux will remain same

60. (B)

OEH is an equipotential surface, the uniform E.F. must be perpendicular to it pointing from higher to lower potential as shown.



Hence $E = \left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)$

$E = \frac{(v_E - v_B)}{EB} = \frac{0-(-2)}{\sqrt{2}} = \sqrt{2}$

$\therefore \vec{E} = E.\,\vec{E} = \sqrt{2}\,\frac{(\hat{i}-\hat{j})}{\sqrt{2}} = \hat{i}-\hat{j}$

61. (D)

$E_{in} = A\frac{dB}{dt} = \pi r^2 B_0\left[\frac{d}{dt}(e^{-t})\right] = (\pi r^2 e^{-t} B_0)$

$\therefore \quad P = \frac{V^2}{R} = \frac{\pi^2 r^4 e^{-2t} B_0^2}{R}$

At t = 0 $\boxed{\frac{B_0^2 \pi^2 r^4}{R} = P}$

62. (A)

Slope of (I– V) graph = $\frac{1}{R}$

In CD slope is –ve So R is –ve.

63. (D)

We can writ R = 10 + t

dQ = I dt

$= \frac{V}{R}dt = \frac{10}{10+t}dt$

$Q = 10\int_{10}^{30}\frac{dt}{10+t}$

$\boxed{Q = 10\ell n 4}$

64. (C)

Weight will first decrease then increase

65. (A, B, C, D)

66. (A,D)

67. (A,B,D)

Work done by force = ΔK.E

$W_E + W_B = \frac{1}{2}m.\{(2V)^2 - V^2\}$

$qE\,.\,2a + 0 = \frac{1}{2}m.3V^2$

$\boxed{E = \frac{3}{4}\frac{m}{9a}V^2}$

P = F.V

= qE.V

$= q \times \frac{3}{4}\frac{m}{9a}.V^2.V$

$= \frac{3}{4}\frac{mv^3}{a}$

At Q, net force will be zero.

68. (A,C)

$$\frac{1}{4\pi\varepsilon_0}\,\frac{Q}{R}+\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{R_0-vt}\right) = 0$$

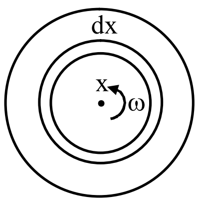
Where R_0 is the initial distance of the charged particle

$$Q = \frac{Rq}{R_0 - vt} \Rightarrow \frac{dQ}{dt} = i = \frac{Rqv}{(R_0 - Vt)^2}$$

69. (A,D)

Consider a ring of radius x and thickness dx.

Equivalent current in this ring = $\frac{\omega}{2\pi}$ × change on ring = $\frac{\omega}{2\pi}$ × $(2\pi\, x\, dx)\,\frac{Q}{\pi R^2}$



dB (due to this ring) = $\frac{\mu}{2x}\left[\frac{\omega}{2\pi}\frac{2xQ}{R^2}dx\right]$

$$\therefore B = \int_0^R \frac{\mu_0\omega}{2\pi}\,\frac{Q}{R^2}\,dx = \frac{\mu_0\omega Q}{2\pi R}$$

70. (A)

$\frac{dB}{dt}$ **=** 2T/s

$E = -\frac{AdB}{dt} = -800 \times 10^{-4}\ m^2 \times 2 = -0.16$ V

$i = \frac{0.16}{1\Omega}$ = 0.16 A, clockwise

71. (B)

At t = 2s,   B = 4T, $\frac{dB}{dt} = 2$T/s

A = 20 × 30 cm^2 = 600 × 10^{-4} m^2;

$\frac{dA}{dt} = -(5 \times 20)$ cm^2/s = – 100 × 10^{-4} m^2/s

$$E = -\frac{d\phi}{dt} = -\left[\frac{d(BA)}{dt}\right] = -\left[\frac{BdA}{dt} + \frac{AdB}{dt}\right]$$

= – [4 × (– 100 × 10^{-4}) + 600 × 10^{-4} × 2]

= – [–0.04 + 0.120] = – 0.08 v

72. (C)

At t = 2s, length of the wire

= (2 × 30 cm) + 20 cm = 0.8 m

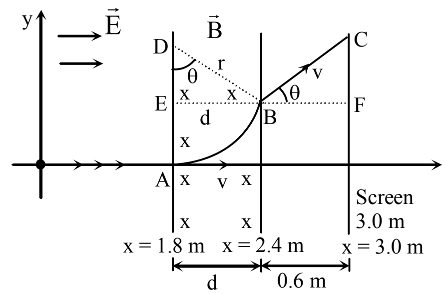
Resistance of the wire = 0.8 Ω

Current through the rod $= \frac{0.08}{0.8} = \frac{1}{10}$ A

Force on the wire = il B $= \frac{1}{10}$ × (0.2) × 4 = 0.08 N

same force is applied on the rod in opposite direction to make net force zero.

Solution for Q no. 73. & 74.



$v_A = \sqrt{2as}$ = v(say)

or $v = \sqrt{2\left(\frac{qE}{m}\right)s}$

$= \sqrt{\frac{2\times1.0\times10\times1.8}{1}}$

= 6 m/s

in magnetic field speed does not change. Hence, particle will collide with 6 m/s.

In magnetic field path of the particle is circle. Radius of circular particle is

$r = \frac{mv}{Bq} = \frac{(1)(6)}{(5)(1)}$ =1.2 m

d = (2.4 – 1.8) m = 0.6 m

Since, d < r

$\theta = \sin^{-1}\left(\frac{d}{r}\right) = \sin^{-1}\left(\frac{0.6}{1.2}\right) = 30°$

AE = r(1 – cos θ) = $1.2\left(1-\frac{\sqrt{3}}{2}\right)$

= 0.6 (2 – $\sqrt{3}$)

FC = BF tan θ = $\frac{0.6}{\sqrt{3}}$

∴ y-coordinate= AE = FC = $0.6\left(2-\sqrt{3}+\frac{1}{\sqrt{3}}\right)$

$= \frac{1.2(\sqrt{3}-1)}{\sqrt{3}}$ m

73. (B) **74.** (**D**)

75. (5)

Let $I = I_0 \sin\omega t$,

where $I_0 = 10$, $\omega = 100\pi$

then $\varepsilon = M \frac{dI}{dt}$

$= M \frac{d}{dt} I_0 \sin \omega t$

$= M I_0\omega \cos\omega t$

$\therefore \varepsilon_{max} = MI_0\omega$

$5\pi = M \times 10 \times 100\pi$

M = 5mH

76. (2)

$\phi = BA$

$\varepsilon = \frac{dQ}{dt}$

$i = \frac{\varepsilon}{R} = \frac{1}{R}\left(\frac{dQ}{dt}\right)$

$dQ = R(idt)$

R_x(Area of i,–t graph)

$dQ = 10 \times \frac{1}{2} \times 4 \times 0.1 = 2$

77. (1)

78. (3)

Magnetic induction at origin is due to one semi-infinite wire and two quarter circle of radii R and 2 R.

79. (6)

Apply wheat stone bridge

80. (1)

81. (9)

$Q_1 \max = 6 \times 10^{-3}C$

$Q_2 \max = 8 \times 10^{-3}C$

If capacitors are connected in series charge on both the capacitor will be same.

$V_{max} = \frac{Q}{1} + \frac{Q}{2}$

$= Q = 6 \times 10^{-3}$

$V_{max} = 9$

82. (4)

In steady state current in AB and CB will be same ie 2A

In loop BCFC

$\frac{Q}{3} + 4 \times 2 + \frac{Q}{6} - 3 \times 2 = 0$

$\frac{Q}{3} + \frac{Q}{6} = -2 \quad \frac{3Q}{6} = -2 \quad \Rightarrow Q = -4 \quad = Q = 4$

83. (4)

$qV_a = qV_b + \frac{1}{2} mv^2$

$2.0 \times 10^{-9} \times 9 \times 10^9 \left[\frac{3\times10^{-9}}{1} - \frac{3\times10^{-9}}{2}\right] \times 100$

$= 2.0 \times 10^{-9} \times 9 \times 10^9 \left[-\frac{3\times10^{-9}}{1} + \frac{3\times10^{-9}}{2}\right] \times 100$

$+ \frac{1}{2} \times 5.0 \times 10^{-9} v^2$

$10^{-9} \times 1800 \left[\frac{3}{2}\right] \times 100 = 18 \times 10^{-9} \times 100 \left[-\frac{3}{2}\right]$

$+ \frac{1}{2} \times 5.0 \times 10^{-9} v^2$

$1800 \left[\frac{3}{2} + \frac{3}{2}\right] = \frac{1}{2} \times 5.0 \times v^2$

$\frac{1800 \times 6}{5} = v^2$

$360 \times 6 = v^2$

$6 \times 6 \times 10 \times 6 = v^2$

$12\sqrt{15} = v$

84. (6)

Apply conservation of energy at centre of ring A and B.